#### CLAIMS

1. An apparatus, comprising:

a fluidic Micro Electro-Mechanical System (MEMS) that is formed including a polymer layer and a substrate portion, the polymer layer of the apparatus comprising:

a containment portion that in combination with the substrate encloses a fluidic channel, wherein the containment portion includes a deep cross-linked polymer region and a shallow cross-linked polymer region, and

wherein the deep cross-linked polymer region and the shallow cross-linked polymer region of the containment portion are formed as a unitary structure.

- 2. The apparatus of claim 1, further comprising a resistor located in, on, or adjacent to the substrate.
- 3. The apparatus of claim 1, wherein a portion of the containment portion that does not contact the substrate includes a shallow cross-linked polymer region and a portion of the containment portion that contacts the substrate includes a deep cross-linked polymer region.
- 4. The apparatus of claim 3, wherein portions of the containment portion that includes the shallow cross-linked polymer region are on lateral sides of the fluidic channel;
- 5. The apparatus of claim 3, wherein portions of the containment portion that includes the deep cross-linked polymer region are separated by the fluidic channel from the substrate.

- 6. The apparatus of claim 1, wherein the apparatus acts as a pump.
- 7. The apparatus of claim 1, wherein the apparatus acts as a polymerase chain reaction (PCR) reactor.
- 8. The apparatus of claim 1, wherein the apparatus acts as a separator.
- 9. The apparatus of claim 1, wherein the apparatus acts as an optical waveguide.
- 10. The apparatus of claim 1, wherein the apparatus acts as a filter.
- 11. The apparatus of claim 1, wherein the deep cross-linked polymer region and the shallow cross-linked polymer region are produced using direct imaging techniques.
- 12. The apparatus of claim 1, wherein the deep cross-linked polymer region and the shallow cross-linked polymer region are produced using lost wax techniques.
- 13. The apparatus of claim 1, wherein the deep cross-linked polymer region and the shallow cross-linked polymer region are produced using dry film techniques.
- 14. A method of making a fluidic Micro Electro-Mechanical System (MEMS) on a substrate, comprising:

depositing a polymer material to form a polymer layer on the substrate; and

hardening portions of the polymer layer to create a containment portion from a shallow cross-linked polymer region and a deep cross-linked polymer region, wherein the shallow cross-linked polymer region and the deep cross-linked polymer region of the containment portion are formed as a unitary structure.

- 15. The method of claim 14, wherein at least a portion of the fluidic MEMS acts as a pump.
- 16. The method of claim 14, wherein at least a portion of the fluidic MEMS acts as a polymerase chain reaction (PCR) reactor.
- 17. The method of claim 14, wherein at least a portion of the fluidic MEMS acts as a separator.
- 18. The method of claim 14, wherein at least a portion of the fluidic MEMS acts as an optical waveguide.
- 19. The method of claim 14, wherein at least a portion of the fluidic MEMS acts as a filter.
- 20. The method of claim 14, further comprising locating a resistor within, of adjacent to, the substrate.
- 21. The method of claim 14, further comprising spinning the deposited polymer material to make the polymer layer more planar.
- 22. The method of claim 14, wherein certain portions of the containment portion are fabricated using a strong exposure cross-linking process, while other portions of the containment portion are fabricated using a weak exposure cross-linking process.

- 23. The method of claim 14, wherein the method includes direct imaging techniques.
- 24. The method of claim 14, wherein the method includes lost wax techniques.
- 25. The method of claim 14, wherein the method includes dry film techniques.
- 26. A method of making a pump on a substrate, comprising: depositing a polymer material on the substrate to create a polymer layer; and

hardening portions of the polymer layer to create a first check valve, a second check valve, and a containment portion from the polymer material, wherein the first check valve, the second check valve, and the containment portion are formed as a unitary structure.

- 27. The method of claim 26, further comprising forming a recessed portion in the substrate that corresponds to each of the first check valve and the second check valve.
- 28. The method of claim 26, further comprising spinning the deposited polymer material to make the polymer layer more planar.
- 29. The method of claim 26, further comprising creating a resistor in the substrate, for forming a bubble to create a pressure differential.
- **30.** The method of claim 26, wherein the first check valve and the second check valve are created using a strong exposure cross-linking process.

- 31. The method of claim 26, wherein certain portions of the containment portion are fabricated using a strong exposure process, while other portions of the containment portion are fabricated using a weak exposure cross-linking process.
- 32. A pump apparatus formed including a polymer layer and a substrate portion, the polymer layer of the pump apparatus comprising:
  - a first check valve including a deep cross-linked polymer region;
  - a second check valve including a deep cross-linked polymer region;
- a containment portion that in combination with the substrate encloses a fluidic channel; and

wherein the first check valve, the second check valve, and the containment portion are formed in the polymer layer as a unitary structure.

- 33. An integrated total chemical analysis system that is fabricated on a substrate using a direct imaging process, further comprising:
- a portion of the deep cross-linked polymer region that defines lateral fluid boundaries of the integrated total chemical analysis system; and
- a shallow cross-linked polymer region for defining upper fluid boundaries of the integrated total chemical analysis system, wherein the deep cross-linked polymer region and the shallow cross-linked polymer region form a unitary structure.
- 34. The integrated total chemical analysis system of claim 33, that includes at least two devices from the group of a filter, a pump, a waveguide, a polymerase chain reaction (PCR) reactor, and a separator.
- 35. The integrated total chemical analysis system of claim 33, wherein the deep cross-linked polymer region is cross-linked using a strong direct imaging exposure process.

- 36. The integrated total chemical analysis system of claim 33, wherein the shallow cross-linked polymer region is cross-linked using a weak direct imaging exposure process.
- 37. The integrated total chemical analysis system of claim 33, wherein the integrated total chemical analysis system includes a fluidic micro electromechanical system (MEM) device.

## 38. A method comprising:

fabricating using a single process a fluidic micro electro-mechanical system (MEMS) device on a polymer layer deposited on a substrate, the fabricating the fluidic MEMS device includes:

defining lateral fluid boundaries of the fluidic MEMS device using a strong direct imaging exposure process; and

defining upper fluid boundaries of the fluidic MEMS device using a weak direct imaging exposure process.

- 39. The method of claim 38, further comprising filtering fluid with the fluidic MEMS.
- **40.** The method of claim 38, further comprising heating fluid with the fluidic MEMS.
- 41. The method of claim 38, further comprising separating fluid with the fluidic MEMS.
- 42. The method of claim 38, further comprising optically detecting material in a fluid using the fluidic MEMS.

- 43. The method of claim 38, further comprising pumping fluid with the fluidic MEMS.
- 44. A method of making a reactor on a substrate, comprising:

forming at least one heating element within, or proximate to, the substrate;

depositing a polymer material on the substrate that creates a polymer layer; and

hardening portions of the polymer layer to create a containment portion, wherein the containment portion is formed as a unitary structure.

- 45. The method of claim 44, further comprising spinning the deposited polymer material to make the polymer layer more planar.
- 46. The method of claim 44, wherein the first check valve and the second check valve are created using a strong exposure cross-linking process.
- 47. The method of claim 44, wherein certain portions of the polymer layer are fabricated using a strong exposure process, while other portions of the polymer layer are fabricated using a weak exposure cross-linking process.
- **48.** A reactor apparatus formed including a polymer layer portion and a substrate portion, the polymer layer portion of the reactor apparatus comprising:
- a containment portion that in combination with the substrate encloses a fluidic channel:
- a portion of at least one heating element that is applied to at least a portion of the fluidic channel;

wherein the containment portion are formed in the polymer layer as a unitary structure; and

wherein certain portions of the containment portion are fabricated using a strong exposure process, while other portions of the containment portion are fabricated using a weak exposure cross-linking process.

49. A method of making a separator on a substrate, comprising: depositing a polymer material on the substrate to form a polymer layer; forming a controllable electric potential source relative to the polymer layer; and

hardening portions of the polymer layer to create a containment portion, wherein the containment portion is formed as a unitary structure.

- **50.** The method of claim 49, further comprising spinning the deposited polymer material to make the polymer layer more planar.
- 51. The method of claim 49, wherein the separator utilizes electrophoresis to separate particles.
- 52. The method of claim 49, wherein certain portions of the containment portion are fabricated using a strong exposure process, while other portions of the containment portion are fabricated using a weak exposure cross-linking process.
- 53. A separator apparatus formed including a polymer layer and a substrate portion, the polymer layer of the separator apparatus comprising:

a containment portion that in combination with the substrate encloses a fluidic channel, wherein the containment portion is formed in the polymer layer as a unitary structure.

54. A method of making a filter including a plurality of filter elements on a substrate, comprising:

depositing a polymer material on the substrate to form a polymer layer; and

hardening portions of the polymer layer to create the plurality of filter elements and a containment portion from the polymer layer, wherein the plurality of filter elements and the containment portion are formed as a unitary structure.

- 55. The method of claim 54, further comprising spinning the deposited polymer material to make the polymer layer more planar.
- 56. The method of claim 54, wherein the plurality of filter elements are created using a strong exposure cross-linking process.
- 57. The method of claim 54, wherein certain portions of the containment portion are fabricated using a strong exposure process, while other portions of the containment portion are fabricated using a weak exposure cross-linking process.
- 58. A filter apparatus formed including a polymer layer and a substrate portion, the polymer layer of the filter apparatus comprising:
  - a plurality of filter elements including a deep cross-linked polymer region;
- a containment portion that in combination with the substrate encloses a fluidic channel; and

wherein the plurality of filter elements and the containment portion are formed in the polymer layer as a unitary structure.

59. A method of making an optical waveguide on a substrate, comprising: depositing a polymer material on the substrate to form a polymer layer; and

hardening portions of the polymer layer to create an input optical conduit, a focusing lens, and a containment portion from the polymer layer, wherein the input optical conduit, the focusing lens, and the containment portion are formed as a unitary structure.

- **60.** The method of claim 59, further comprising spinning the deposited polymer material to make the polymer layer more planar.
- **61.** The method of claim 59, wherein the input optical conduit and the focusing lens are at least partially created using a strong exposure cross-linking process.
- 62. The method of claim 59, wherein certain portions of the containment portion are fabricated using a strong exposure process, while other portions of the containment portion are fabricated using a weak exposure cross-linking process.
- 63. A waveguide apparatus formed including a polymer layer and a substrate portion, the polymer layer of the waveguide apparatus comprising:
  - an input optical conduit including a deep cross-linked polymer region;
  - a focusing lens including a deep cross-linked polymer region;
- a containment portion that in combination with the substrate encloses a fluidic channel: and

wherein the input optical conduit, the focusing lens, and the containment portion are formed in the polymer layer as a unitary structure.

### **64.** A method comprising:

depositing a structural material layer that defines the lateral boundaries of at least one fluidic channel of a fluidic micro electromechanical system (MEMS) device; and

laminating a dry film layer on the deposited structural material to at least partially define an upper layer that of the at least one fluid channel.

# **65.** A method comprising:

depositing a sacrificial material on a substrate;

depositing a polymer layer on the substrate and the sacrificial material; and

removing the sacrificial material to at least partially define boundaries of at least one fluidic channel of a fluidic micro electromechanical system (MEM) device, the at least one fluidic channel is at least partially defined by a portion of the polymer layer and a portion of the substrate.

#### **66.** An anchor apparatus, comprising:

a deep cross-linked polymer region;

a shallow cross-linked polymer region supported by the deep cross-linked polymer region, the shallow cross-linked polymer region having a thru-hole formed therein, wherein the deep cross-linked polymer region and the shallow cross-linked polymer region are attached; and

a connector portion that secures to the thru-hole, wherein the top-hat structure enhances the attachment of the connector to the thru-hole.

- 67. The anchor apparatus of claim 66, further comprising glue to secure the connector portion to the thru-hole.
- 68. The anchor apparatus of claim 67, wherein the shallow cross-linked polymer region forms an overhang portion, wherein the glue is affixed to the overhang portion in a manner to enhance the attachment of the connector to the thru-hole.
- 69. The anchor apparatus of claim 66, further comprising epoxy to secure the connector portion to the thru-hole.

70. The anchor apparatus of claim 66, wherein the deep cross-linked polymer region and the shallow cross-linked polymer region form a top-hat structure.